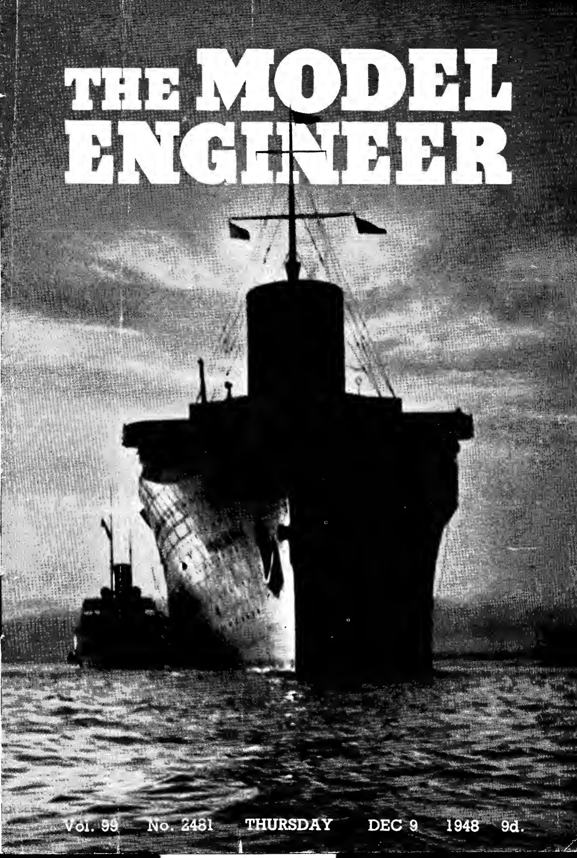
THE MODEL ENGINEER



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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THIS WEEK's illustration is reproduced from a photograph, submitted by Mr. J. A. King, of Welling, of the great French liner *Normandie.* The photograph was taken on a summer evening in 1937 as she lay in the Solent off Ryde, Isle of Wight. She was not calling at Southampton owing to a dispute over the docking fees, and the mail was being taken off by two tenders, one of which can be seen lying alongside. The other tender—the paddle steamer *Gracie Fields*—has just cast off and the stern can be seen to the right of the picture.

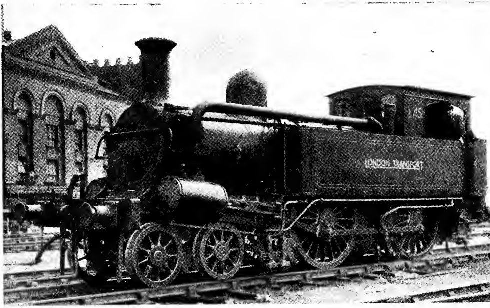
The semi-clipper stem and the turtle back on the fo'c'sle head, together with the tremendous size of the funnel, give an outline which suggests power and speed to a degree, and one which is unique among ships.—E.B.

Model Engineering and Industry

● MODELS OF all kinds have long been employed in the engineering industry for all sorts of purposes, such as publicity, planning, preliminary investigation of design, and research work; but model engineering, in an indirect sense, is capable of playing a still more important part in the progress and efficiency of engineering production. Many well-known engineering firms have found that workers who take an interest in model engineering are almost invariably keen, quick to learn and adapt themselves to new methods, also resourceful in tackling unusual problems, and above all, acquire a conscientious pride in the execution of good work for its own sake; all of which properties cannot fail to be of great value to their employers. Slowly but surely, the model engineer is becoming recognised as an asset to industry, and many firms are encouraging the formation of model clubs under the aegis of the works, either in co-operation with apprentices' training schemes, or as a branch of social welfare organisations. This policy is a welcome change from the conditions which existed in the early days of my engineering career, when anyone in the works known to be interested in models would be marked down as a suspect in respect of pilfering of materials, and making "foreigners" in the firm's time. Speaking from actual experience, the workers most commonly guilty of these misdemeanours were not model engineers, however, but promiscuous "handymen" who were keen to turn an honest (or dishonest) penny in some odd job for a friend or neighbour. But in any case, recognition of the fact that an employee's interest in models is a benefit to industry, rather than an evil, will effectively remove any such suspicion; and the provision of facilities for spare-time work on models is a long overdue but none the less praiseworthy policy in industry which, I trust, will increase in popularity and eventually be considered as normal and indispensable as the works canteen.—E.T.W.

Portrait of L45

● MY RECENT note about the preservation of the old Metropolitan Railway 4-4-0 tank engine No. 23, later London Transport No. L45, caught the eye of our old friend Mr. George R. Stevenson, who has very kindly obtained for me a nice photograph of the old engine. From her portrait, the engine seems to be in good condition; but I am interested to notice evidence of minor modifications that have had to be made to adapt her to modern requirements. The snow-brushes, steam-heater pipe connection and the trip-cock for emergency brake application are, perhaps, the most prominent of the "extras."—J.N.M.



Proposed Club for Llandudno

● A LETTER from Mr. D. White tells us that he and his friend, Mr. R. G. Jones, are trying to form a model engineering club in the Llandudno, Colwyn Bay district. They are at present collecting names of those interested and when sufficient are received, it is proposed to call an inaugural meeting. They ask any readers living in this area who may be interested to write to Mr. D. White at "Chez-Nous," Penrhyn Avenue, Rhos-on-Sea.—P.D.

From a Young Enthusiast

● I WAS pleased to receive recently a letter from Master J. A. Woodrow, of Bexleyheath, whose age is 13. He writes: "While on my holidays at Street End, near Canterbury, I saw, to my amazement, six Fowler traction engines going down the road. They were obviously quite recent types. I am sorry that I cannot tell you who owns them, or where they are kept."

Had I seen such a sight, I, too, would have been amazed, as well as delighted. It would be interesting to know where those six engines were going; perhaps some reader more familiar with the district than I am could offer some explanation. I believe that the largest number of engines I have ever seen together on the road is three; this was many years ago, on a Berkshire by-way not far from Thatcham. Two of the engines were ploughing-engines of what then seemed to me to be enormous size; the third was a smaller engine hauling two flat wagons which, if I remember rightly, were not loaded. But I wish I had had a camera with me at the time; and I can imagine that Mr. Woodrow, had he had one with him when he saw that remarkable procession near Street End, would have hardly failed to use it. But I am rather dubious about those "quite recent types"; it is more likely that the engines had been recently overhauled.—J.N.M.

Progress at Ickenham

● MR. H. C. PIGGOTT, hon. secretary of the Ickenham and Ruislip Model Club writes to inform me that the membership is steadily growing; three new members were elected at the meeting on November 19th. One of the members has presented the club with a notice-board made by himself. This is a useful gift for which, I have no doubt, the other members have expressed due gratification.

There is a possibility that the Railway Executive will be providing either a lantern lecture, or a cinema show dealing with railway matters in the near future; details will be announced at a later date.

The club's "live steamers" now number seven; but enthusiasts for the smaller gauges may be assured of a welcome, and prospective new members should get in touch with Mr. Piggott, at "Chatsworth," Parkfield Road, Ickenham, Middlesex; he will be pleased to supply all necessary information.—J.N.M.

★"Rejuvenating Grandpa"

by "Artificer"

Some Practical Notes on the Repair and Restoration of Old Clocks

Depthing tool for finding the correct meshing distance between centres of clock gears. (By courtesy of E. Gray & Son Ltd., Clerkenwell)

AFTER dismantling and cleaning the components of the clock movement, a very careful examination of all parts should be made, to detect signs of wear or damage. In many cases, wheel and pinion arbors may be found to be bent, and must be carefully straightened. A rough check on the straightness of the arbor and the truth of the wheel face, may be made by twirling the wheel in the fingers, but much better accuracy can be obtained by spinning it between fixed hollow centres, either in the lathe, or in a simple fixture made for the purpose. Concentrate on straightening the arbor first, remembering that the pivots are the most important part, and being smallest in diameter, also the most likely to be bent. Be very careful to find exactly where the bend occurs and to apply the appropriate treatment at this point; otherwise, instead of taking one bend out, it is quite easy to put two more in. The pinions and wheels should run dead true with the pivots, and if any side wobble of the latter is detected, this should also be dealt with.

Repolishing Pivots

The working surface of the pivots will usually be worn and scored, and will require repolishing, the orthodox method of doing this being by filing with a dead smooth file and afterwards burnishing. Before doing so, however, it is a good idea to check up on the roundness of the pivot with a micrometer, as in some cases, it is found to be worn oval, an error which cannot be corrected by the ordinary process of filing in the lathe, unless a pivot filing rest is available. The latter is an item of equipment only supplied with horological lathes and not usually available in the model workshop. In its absence, the high spots on the pivot may be eased down by hand filing, and the general roundness checked before applying the file when running in the lathe.

To avoid undue strain on the pivot during filing and burnishing—the latter calls for fairly heavy pressure—it is advisable to support it in a notched steady made of hardwood, bakelite or metal; the tail centre cannot be used as a rule, as it would prevent access to the full length of the pivot. Hold the other end by the thick part of the arbor if possible, in preference to the pivot, in a collet chuck or a bush held in the three-jaw chuck, bored out truly to fit the arbor fairly tightly. Apply the file just sufficiently to remove signs of wear, and make sure that it is not tapered the wrong way; a slight taper towards the point is not a disadvantage, but must not be overdone. Lapping with fine emery powder, or the rubbings from an oilstone, on a soft metal lap, kept constantly on the move, will remove the file marks, and after removing all traces of abrasive, final burnishing with a hardened steel burnisher and oil, will produce a glass-like polish resistant to both wear and corrosion. The shoulders of the pivots should receive just as careful treatment as the parallel portion.

Rebushing Clock Plates

The effects of wear in the pivot bearings in the plates will also call for correction, especially as the size of the pivots has been reduced by repolishing. It is usual to drill out the holes in the plates and fit bushes, or "bouchons," as they are called in the trade. This is a fairly straightforward job to any competent and intelli-

**Continued from page 555, "M.E.," November 25, 1948.*

gent engineer, but evidence afforded by clocks which have been through the hands of repairers shows that some atrocious crimes have been perpetrated on them—whether by amateurs or professionals, it is impossible to tell. Only too often, the only "rebushing" done has been effected with a hammer and a pin-punch—or only the hammer, perhaps; the method being to compress the metal of the plates around the pivot

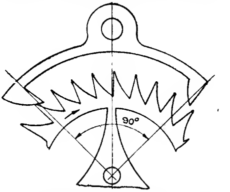


Fig. 1. *Anchor or recoil escapement of the type usually fitted to English long-case clocks*

holes so that it swells into the hole, and thereby reduces its diameter—but mostly at the edges and hardly at all in the centre of the plate thickness. This treatment has, apparently, been applied two or three times in some cases, resulting in marring the surface of the plates beyond recall, and often distorting and buckling them.

To the amateur worker who does not grudge the time taken, it is no very difficult matter to rebush clock plates properly, by drilling out the holes and fitting a tight bush of suitable material, having an undersize hole which is subsequently broached or reamered to take the pivot. It is, however, necessary, to ensure that the pivot hole centres are maintained in exactly the correct location—which is not always automatically ensured simply by entering an oversize drill in the old pivot hole. The latter is often worn out of round, and in one direction—in fact, this is the rule rather than the exception. When the direction of wear is fairly obvious, it is possible to open out the hole with a round file in the unworn parts, to restore general accuracy of original location, before drilling and reamering out to take the bush. In very bad cases, however, it may be necessary to plug the hole with solid metal and re-locate the pivot hole; not too easy a job, in view of the fact that most of the pivots have to be located to obtain correct mesh adjustment with wheels and pinions on both sides, but not diametrically opposite. The use of a clockmaker's depthing tool, if available, will facilitate this work; the device in question consists, as shown in the photograph, of two frames carrying double-ended centres for the clock pivots, the former being hinged together for adjusting the centre distances of arbors placed between respective centres. The particular pair of wheels, or wheel and pinion, to be tested, is run in the two sets of centres, the hinge being adjusted till they run sweetly in mesh. Extended centre points at one or both ends of the centres constitute a trammel which enables the centre distance to be measured, or scribed off directly on the clock plates.

The material used for bushing the plates is, of course, highly important. In the clock trade, hollow bouchon stock in a wide range of sizes is obtainable, but the model engineer will probably find this difficult to obtain, and it is not a big job to turn the bushes from solid stock material. Ordinary machine brass or screw rod, however, should not be used, as it is not a good material either for withstanding wear or reducing friction. Drawn or cast gunmetal, such as often found in the model workshop, is much better for the purpose. The bushes should be turned slightly longer than the thickness of the plates, and a firm press fit in the opened-out holes; after insertion, they are lightly hammered down with the flat face of the hammer, to swell the ends just sufficiently to key them in firmly, after which they are, preferably finished flush with the plates, so that the joint is practically invisible. There may, however, be an advantage, in some cases, in leaving them longer, to provide better bearing surface, and shouldered bushes have been found useful where the plates are very thin; but this is of no avail unless the pivots are long enough to take advantage of the extra bearing surface.

The holes in the bushes are carefully broached to fit the pivots, and the outer faces of the holes well countersunk to provide an oil-retaining space; the inside face should also be slightly countersunk, or at least de-burred, to ensure that it does not foul the pivot shoulder. Each arbor in turn should be tried out in its position between the clock plates, the latter temporarily assembled, to check free running. A slight end-play should

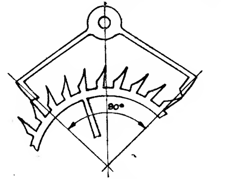


Fig. 2. *Graham or "dead-beat" escapement, with solid pallets*

be allowed, but no side play should be perceptible in any of the pivot bearings.

The hour-hand of a normal eight-day clock is attached to a "cannon" or pipe, which runs on the outside of the minute-wheel arbor. If the latter has been repolished, or if wear of the cannon has taken place, it may be found necessary to renew the latter, as re-bushing such a thin sleeve is hardly practicable. This entails removing

and remounting the hour-wheel, an operation which calls for some care to avoid distorting the wheel. Properly made stakes and punching blocks for removing wheels and pinions are not difficult to make, and will always repay the trouble taken, In many old clocks, other wheels, such as those in the motion work on the front of the plate, and levers for striking and chiming gear, are mounted on cannons, the pivot being a pin (usually tapered) fixed in the clock plate by riveting or screwing; in such cases, wear is most readily taken up by broaching out the cannon and renewing the pin. After final fitting of pivots, or any other form of bearings, the holes should always be thoroughly cleaned by pegging to remove the last traces of abrasive or metal dust.

Escapement Wear

Assuming general mechanical efficiency of the wheel train of a clock, the part which has the most influence on its successful working and accurate timekeeping is the escapement. This is quite a simple mechanism, in the clocks we are considering, but it is perhaps the least understood of all parts of the clock, and only too frequently, is found to be badly out of adjustment. The form of escapement used on most of the English old clocks is that shown in Fig. 1, known as the "anchor" or recoil escapement, the former term being derived from its general shape, and the latter by reason of the fact that it causes a slight movement of the escape wheel in the reverse direction, when the impulse applied to the pendulum causes it to swing farther than is necessary for the unlocking of a wheel tooth. This feature affords a measure of self-governing, or "compensation," when the driving power varies.

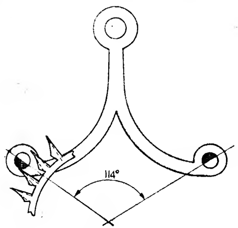


Fig. 3. Brocot "visible" escapement, with half-round jewelled pallets

The recoil escapement has been improved upon in many ways, and at various times, since it was invented by Dr. Hooke, a contemporary of the great Sir Isaac Newton, in 1656; but it is a robust and sound device which gives fairly accurate timekeeping, at least in weight-driven clocks where the impulse is constant, and it has been, and probably still is, the most popular escapement for domestic clocks. The improved forms of escapements only show their superiority in clocks having exceptionally good mechanical design and construction, in conjunction with devices for temperature and climatic compensation of the pendulum. Space does not permit of a dissertation on the theory of escapements here, and it is intended to explain only what attention to this part of the mechanism is likely to be required; in any case, careful observation of the action of an escapement in a clock will teach the practical worker far more than can be expressed in mere words.

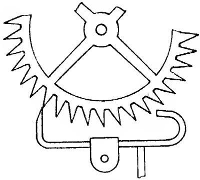


Fig. 4. Underslung recoil escapement of the type fitted to cheap American clocks

Leave Well Alone

In most old clocks, the teeth, or "pallets" of the escapement will be found worn or rutted, and one is tempted to cut back the working surface to remove this unevenness; but this should not be done, at least by the worker without special experience in clock repair or adjustment. The reason for leaving well alone is that any alteration to the points of the pallets not only alters the radial adjustment from these points to the anchor pivot, but also the angular span of the teeth over the escape wheel. It is possible to adjust the radial distance by shifting the position of the pivot, but the angular span of the teeth can only be altered by bending the arms of the anchor or by further filing of the pallet faces, either of which is a rather delicate job for the inexperienced worker to undertake.

Pallets

In any case, the pallets are usually glass-hard, and can only be touched with a grinding wheel or abrasive slip; in many cases the arms are also rather brittle, though not as hard as the pallets, and have often been broken in course of manipulation in this way. Some of the more expensive clocks, such as regulators, have inserted pallets of hard, polished steel or agate, which can be advanced to compensate wear, or turned end for end, without affecting working angles. But even with these, the novice will find it indiscreet to meddle unnecessarily. The form of escapement generally used in most clocks of this type is that introduced by Graham, and known as the "dead-beat"

type, as no recoil of the escape wheel takes place after locking. (Fig. 2.)

Fortunately, it is usually possible to shift either the anchor or the escape wheel endwise slightly on its arbor, and the pallets being broader than the wheel teeth, this allows a new and unused surface of the pallets to be brought into action. It is interesting to observe that the much softer brass escape-wheel teeth are rarely worn to any great extent; if, however, the tips of the teeth show signs of wear, the main thing to watch is that they are all the same height (i.e. concentric) and free from roughness; a slight broadening of the tips does not seem to affect working to any great extent.

For those who wish to undertake any extensive refitting of the pallets and escape wheel, or make completely new parts, it may be remarked that Mr. George Gentry, several years ago, described the layout of these parts in detail, including the construction of a special jig for filing and lapping the faces of the pallets at exactly the correct angles.

In most of the clocks under consideration, the pivot at one end of the escapement is carried in a "cock" or bridge-piece, which makes it possible to adjust the radial depth of the pallets within a small limit. But some of the old clockmakers, having once set the pallets to correct depth, fixed their location by dowel pins through the cock fett and the back frame plate; and in such cases it will be necessary to remove the pins, and possibly elongate the fixing screw holes, before adjustment can be effected.

Escapements

A few words on escapements other than those of the type found on English clocks may be helpful. In some continental clocks, the pallets are in the form of steel pins projecting sideways from the "anchor," and these can be reset or renewed if necessary. The French Brocot escapement, as fitted to many marble clocks (often visible from the front of the dial) has, in its best form, jewels such as agates or carnelian stones in place of pins, and these are hardly likely to require attention. (Fig. 3.) Some of the American domestic clocks produced during the last century have a particularly cheap and nasty form of escapement, in which the "anchor" is a bent steel strip, with sheet brass lugs brazed on, pivoted on a pin carried in a cock mounted either above or below the escape wheel. (Fig. 4.) It must, however, be admitted that some of these clocks gave much better and longer service than might have been expected in view of their flimsy construction, with thin wheels and motion plates; but they were never good timekeepers. Some continental clocks had similar strip steel pallets, but they were usually mounted on a more substantial arbor pivoted between the main plates, with or without a bridge cock, in the normal way.

(To be continued)

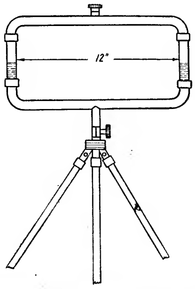
An Old Water Level

by B. Jefferies

THE description of a water level by H. H. Nicholls in the June 24th issue of THE MODEL ENGINEER prompted me to take out of cold storage a water level which my father used back in 1875 when employed by the South Staffordshire Mines Drainage Commissioners. In later years he used the more up-to-date surveyor's optical level, and in due course the old water level came into my possession.

Being one of those peculiar people who hesitate to destroy anything that is well made, however old-fashioned and out of date, I have kept the instrument, and it is in perfect condition.

The sketch is almost self-explanatory. The level is made of substantial brass tubing, with glasses of sufficient diameter to ensure correct reading of the surveyor's "staff."



It is equipped with tripod and, when not in use, can be detached and packed away in a wooden box. It is not necessary to let out the water, as the instrument is quite watertight. A label inside the box indicates that the level was made by Adie & Son, Opticians, Mathematical and Philosophical Instrument Makers to the Queen, No. 50, Princes Street, Edinburgh.

The old level has not been entirely idle since my father used it, for in my work in the teaching profession, I found it useful to demonstrate the scientific fact that a liquid "finds its own level."

A Successful Refrigerator

by J. W. Grazebrook

THE following notes are given of my experiences with a home-made refrigeration plant, not with any idea or claim that it is my own design, but rather to show that these units are easily built and run by the inexperienced.

In THE MODEL ENGINEER of October, 1937, a design was given by "Freezer," and then in 1945 we had the very excellent and complete layout by Mr. Meyland Smith.

My own effort was first built in 1939, and I left it working when I went into the Army. A pipe cracked during the war years, so I reconstructed the apparatus in the light of my own experience, and with the help of the later notes.

The cabinet is a very straightforward job, even if you dislike woodwork as much as I do. My size is six cubic feet, and the whole outfit is made as one, with the unit immediately below the cabinet. Five-ply wood was used on framework of $1\frac{1}{2}$ in. sq., and the intervening space was packed with granulated cork. This insulation has proved all right, but I notice in the hot weather that moisture forms on the outside of the cabinet, which I have not seen on the commercial ones. The door has similar insulation. Unfortunately, I fitted this flush with the side of the cabinet, so was unable to use the normal commercial type of fastening. In practice, the door is a very good push fit, and a simple catch has so far sufficed. The space for the unit is left open at the back and underneath, with a separate front which is a push fit. May I support the advice given that the inside should never be painted? I lined mine with zinc, as I could not get the aluminium at the time, and painted it, including the evaporator, with three coats of enamel. The result was that the paint would not stick well on the zinc and the smell of paint was still there after six years. Literally everything put into the cabinet tasted of paint.

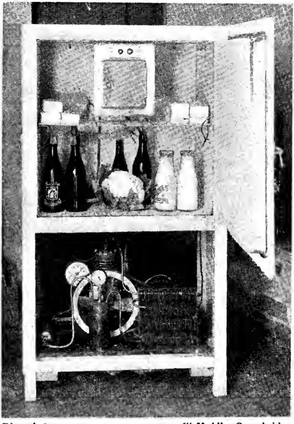


Photo by] [" *Hal*," *Stourbridge*

The complete refrigerator

The most interesting part of the job was the unit. I am afraid I bought my compressor, and it was one advertised by Gamages at £3 3s. before the war, complete with packless gland which I believe to be essential. This was done very well, but it is inclined to be noisy, particularly at certain pressures, and one day I shall probably build myself a quiet one. The system used is a mixture of the two published designs and some of my own. All valves are home-made and none of them has given any trouble. They operate with a double cone so as to seat in the on and off positions and keep pressure as far as possible off the gland.

It is possible to imprison the gas almost anywhere with these valves, for dealing with any troubles without loss. The condenser is a horizontal one, as shown by "Freezer" and has fins cut from sheet soldered on ; and well I knew it at the time, for there are over a hundred. If made to this design again, I should make the condenser much bigger, with a far stronger framework, as mine has shaken adrift, and in any case I think the size is too small as compared with the commercial type.

The liquid container calls for no comment, being just a piece of 3-in. copper tube, with ends brazed in, and an oil gauge mounted on it.

The next item in my circuit is a dryer, and

this I have built up of thick brass tube, with ends silver-soldered on, having screwed connections for the pipes. This unit is left in place all the time, and no other drying of the system has been carried out. The original calcium is still in it, after nine years, and so far, no trouble has shown up. The evaporator is as shown by Mr. Meyland Smith, and I have found it easy to assemble and efficient in operation. Originally, I built my own expansion valve, which was an ordinary fine-thread screw-valve, very carefully made. It relied on its packing to keep tight, of course, and I was always a little apprehensive, but there was no leakage here. It could be adjusted as required and I suppose come near to a fixed orifice. On rebuilding, I bought an automatic valve and I have not regretted it. With a fixed orifice, the gas will even out its pressure on each side when the unit cuts out, and, on restarting, it takes a long time to pump out the gas on the vacuum side before refrigeration starts. It seems to me that this cannot be overcome unless the orifice is made unduly small, when you get too high a vacuum and too little refrigerant going through.

Cone-and-Socket Joints

All joints are made on the cone-and-socket principle, and have given very little trouble after the initial tightening up. They are easy to make in copper, and, personally, I have never needed to re-anneal them after they have been undone. The only exceptions are that flare joints are formed on the automatic valve as purchased. However, they seal this with two blind flares, and if these are silver-soldered into the pipes, and then drilled, there is no need to make special flares for this part. For gas I have always used methyl chloride, for I don't trust the properties of SO_2. Admitted, you have to work at a higher pressure, which is about 50 to 60 lb., according to room temperature, but that is no trouble. It is almost odourless, and has no obvious unpleasant habits. I.C.I. were of great assistance in providing this. There is one thing I have found invaluable, and that is a vacuum gauge, for, with the gauge on the pressure side, the whole story is shown, and one knows where to look for trouble if anything goes wrong.

The system must be gas-tight, and be kept so for a few days before charging, otherwise there will be heavy loss of gas. A little paint on an obstinate leak at a union does the trick. After some time of running, the only snag I have had to contend with is dirt on the compressor valve. The smallest bit stops the clock, and it comes from dirt in the pipes; these should be well cleaned before assembly, which I forgot to do. However, I can have the head off my compressor and on again in under five minutes. With the aid of the valves mentioned, this has been done four times, and no more gas has been needed. I believe there should be a vacuum on the one side of the system, but I have never had successful working in this condition. It makes the unit noisy, and not enough gas gets through, so I aim to work at about three pounds pressure here. Noise is the big trouble. The motor is a 1/6th-h.p. Hoover, and it is mounted on four leather straps hung across the unit frame of old bedstead

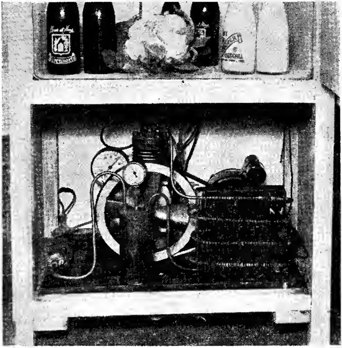


Photo by] [" *Hal*," *Stourbridge*

View of unit, showing condenser container, dryer and gauges

angles. On top of this is a piece of 1-in. sorbo, and then comes the motor on a base-board with no attachment whatever other than a $\frac{3}{8}$-in. tensioning strap. I have found from experience that any attempt to secure the motor by its base or otherwise is noisy. A loose motor is the only hope. I have tried mounting the unit on rubber and springs with little success. One last hint: Put all the pipes where you can get a tray underneath, otherwise when you defrost, the cabinet is flooded. The photographs make the general arrangement of the mechanism fairly clear. When they were taken, condensation had set in in a big way, causing marks on the inner door and inside the cabinet.

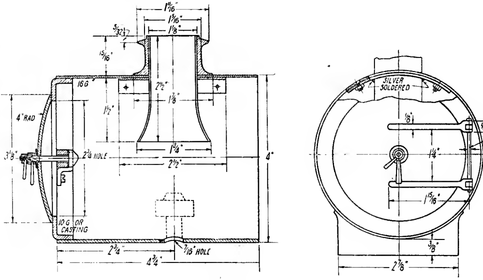
I hope the above will assist anyone who may be hesitating. I am a lawyer by profession, with no mechanical training, and I found the job simple.

A 3½-in. Gauge L.M.S. Class 5 Loco.

by "L.B.S.C."

As last week's dissertation was all about smokeboxes, I thought it would be a good thing to follow it up with the notes and drawings of the smokebox for the L.M.S. Class 5 engine. Although "Doris" isn't as big as either "Maid" or "Minx," the construction of the smokebox is practically the same, so that the instructions already given, will serve also for this job. The

The liner is a 2½-in. length of 1⅛-in. tube, 18- or 20-gauge, brass or copper, it makes no odds. Soften it, and bell out the bottom end to approximately 1¾ in. diameter, as shown; this is merely to ensure that all the steam from the four blower jets, which are set in a ⅝-in. circle around the blast nozzle, goes up the liner. I might point out that there is no need for an outsize bell in a



Smokebox for "Doris"

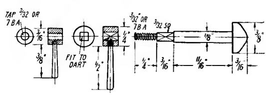
diameter of the smokebox tubeplate over the flange, was given as 3⅞ in., the tapered end of the barrel being filed to suit; so if we use a piece of 4-in. by 16-gauge brass tube for the smokebox, it will fit nicely on the projecting flange, and the outside will be flush with the end of the taper barrel, which is as it should be. If no tube is available, the smokebox barrel may be rolled up from 16-gauge sheet brass, and either lapped and silver-soldered, or butt-jointed, veed, and Sif-bronzed as mentioned last week. In any case, the tube, whether drawn or home-made, should be squared off in the lathe to a length of 4¾ in.

The hole for the chimney liner is 1⅛ in. diameter, and 2¾ in. from front end; the hole for the blastpipe is diametrically opposite and in line, and drilled 7/16 in. Note: if you have rolled up the smokebox barrel from sheet, and lapped the joint, there is no need for the blastpipe hole to go through the lap. Drill it first, as close to the joint as possible, and then drill and ream the hole for the liner afterwards, exactly "across the way." The lap joint doesn't have to be exactly on the bottom line of the smokebox, as long as it is inside the saddle.

chimney liner; in a little engine it can be overdone to an extent which, by obstructing the inside of the smokebox, defeats its own ends. Most of my engines have plain straight liners without any bell at all, old "Ayesha" being one, and nobody could ever accuse her of being short of steam. She is now trying to burn up her tenth set of firebars! Engines with fairly long chimneys, such as my old "Ancient Lights," don't need a liner at all; and the only reason I fitted them to "Jeanie Deans" and "Grosvenor," was to provide a sort of spigot over which to fit the chimney. They only just project into the smokebox. The liner for "Doris" is fitted in a 2½-in. square of 16- or 18-gauge brass or copper, same as the "Maid," and attached to the smokebox by four 3/32-in. or 7-B.A. countersunk brass screws, nutted inside the smokebox as shown.

The chimney itself is a casting, and a plain turning job needing no detailing-out. If the core-hole is rough and undersized, bore it out like a cylinder, so that a piece of 1⅛-in. tube will be a tight fit in it. Then mount on a mandrel—bit of hardwood would do—and turn the outside to the profile given. The radius at the bottom can be

cleaned up with a file; or you could put a piece of thin emery-cloth or other abrasive over the smokebox barrel, and give the chimney a few rubs on it. The slight difference in radius caused by the thickness of the emery-cloth, is nothing to worry about. As the chimney should have the proper "L.M.S. look," I have given all the diameters and the height. Somebody who built a "Princess Marina" told me he made six chimneys altogether, to try and satisfy a relative of Inspector Meticulous in his local club. Whilst I fully agree that the shape of a chimney can make or mar the appearance of the engine, there are some chimneys I detest. The awful nightmares that disfigure the smokeboxes of some of the Southern "Nelsons," "Schools," and Maunsell 0-6-0's are absolute eyesores, especially the latter, which are lower than the dome. Could you imagine a G.W. "Castle" or "King" with such an excrescence on the boiler—the thought is enough to make anybody feel queer! If I don't like the "regulation" chimney for any particular class of engine, I just fit another one altogether; "Tishy" and "Cock-o'-the-North" both have neat stovepipe chimneys, and "Fernanda" has one like the L.M.S. "Princess Royal." But "Jeanie Deans" and "Grosvenor's" chimneys just yell Crewe and Brighton at you!



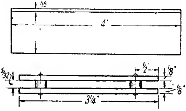
Dart and handles

The smokebox ring, door, crossbar, dart and handles are made as described last week, but to the sizes shown in the accompanying illustrations. Probably some builders will prefer to knock up the ring and door from brass blanks; I rather favour this method myself in the smaller sizes. There is a little difference in the hinges. Instead of the usual solid lug on the end of the hinge strap, the full-sized "Class 5's" have a sort of bifurcated hinge, as shown in the drawing. Cast smokebox doors will probably have the lug cast solid; and the recess for the corresponding lug on the ring, will have to be filed or milled, but that is a simple job, anyway. There is no difference in the manner of drilling and fitting the hinge pins. Use No. 51 drill, and $\frac{1}{16}$-in. silver-steel or rustless steel pins, slightly burred at the top, so that they can't fall through and get lost on the road. If the hinge straps are made separate, as in the case of a door knocked up from a brass blank, use a piece of metal the full width of the hinge lug; then, after bending the eyes to shape, and silver-soldering them, file away the surplus before bending to suit the contour of the door.

The saddle will be a casting, and all it should need is a bit of cleaning up with a file; it should fit tightly between the frames, but not enough to spring them. Instructions for erecting will be given when we come to the job of erecting the boiler on the chassis. Next stage, staying, boiler fittings and mountings.

Misleading, Yet Correct!

A correspondent, in a recent letter, relates an experience which he thinks should be given publicity, in order to prevent others falling into a similar trap. Our friend was in the market for


Saddle and crossbar

a serviceable used engine, having a young hopeful who was decidedly "locomotive-conscious"; he had managed to put up a garden line on which the boy could ride, but had not the time, nor the equipment, to build an engine to run on it. He was offered what was described as a "live steamer" at an attractive price; and as he had read my notes for a considerable time, had come to regard the words as implying that the engine was one built to my specifications, and closed with the offer, paying the money without seeing the engine at all, and taking the vendor's word that it was in good order.

When the engine arrived, he found that not only was the workmanship very poor—the engine could hardly pull its own tender—but it was of a commercial type which I have never described in these notes. He took the matter up with the vendor, and said that calling the engine a "live steamer" was a gross misrepresentation, as it was not a "L.B.S.C." type. The vendor promptly repudiated this, saying that he did not claim it to be one of my designs, adding that any engine which took steam direct from the boiler, could legitimately be called a "live steamer." My correspondent asks if this is correct.

Unfortunately for him, it is. Your humble servant has not the slightest proprietary right over the use of the words "live steamer"; a child's spirit-fired toy is as much entitled to be called a "live steamer" as my "Tugboat Annie," and the term is freely used in Canada and U.S.A. by writers who maybe have never seen a copy of this journal. My notes were formerly published under the heading *Shops, Shed and Road—a Column of Live Steam*, and by virtue of that, the term became unconsciously coupled with the locomotives described in those same notes, which I called "live steam" specifications. One of the reasons why I give my locomotives their distinctive names, is to avoid anybody being misled, inadvertently or otherwise. Although I cannot claim any proprietary rights over the generic term as mentioned, I can, and most emphatically do claim them over the designs of the locomotives specified by name or other distinction. Anyway, to save any misunderstanding in the future, I shall not refer to "live steam" specifications,

but to " L.B.S.C." specifications, and then there can be no mistake; so if you hear of, or see any engines advertised as " live steamers," remember our worthy friend's experience, and do not necessarily couple them with your humble servant. They may be something entirely different altogether!

Built " On the Quick "

The reproduced photograph shows a " Maid of Allsorts " built by Mr. P. S. Lamb, a Stratford-on-Avon follower of these notes. Mr. Lamb set out to do the job as quickly as possible, and completed the whole bag of tricks in just ten months. Although the locomotive is not a copy of anything running on British Railways at the present time, the various working parts, and the boiler, are made according to the instructions given in these notes; and in consequence, the engine can do the job all right. Our worthy friend says that she is a " three-jaw-chuck job " throughout, the cylinders being held in same with some weird and wonderful pieces of packing to get them to run truly for boring and facing; it panned out all right, but took rather a long time setting them up, to the accompaniment of a little railroad Esperanto. The wheels were turned at one setting apiece, by gripping the little boss at the back, in the three-jaw; he says that there was only about $\frac{1}{8}$-in. to hold them by, but they never came out, and suggests that if all castings were provided with a chucking-boss, they could be machined at the one setting.

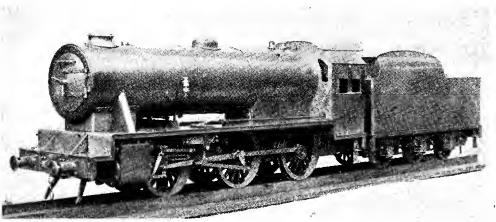


Photo by] *A quick job by Mr. P. S. Lamb* [*T. F. Holte*

Some wheels are; I have a set of " Fayette " coupled wheel castings here at this minute, with chucking pieces on the back about $\frac{5}{8}$ in. diameter and just over $\frac{1}{2}$ in. long. I have personally tried to turn iron wheel castings at one setting, but find there is a tendency to chatter when turning the treads and flanges, even on my " Type R." Milnes lathe. Also, each wheel needs at least four changes of tools for facing both sides, turning treads and flanges, and forming the little rebate at the front of the rim, which simulates the junction between tyre and wheel-centre, well in evidence on all my own fleet of locomotives. Then there is the trouble of turning all the treads to matching diameters, by separate measurement; and finally, the wheel has to be chucked back outwards, to face off the chucking-piece. I think I have tried about every possible method of wheel turning; and the one I recommend, is the one which I have found not only the easiest, but gives the best results, especially in getting all the coupled wheels to the same exact diameter. The support given to the tread and flange by the improvised faceplate, minimises chatter even on a small lathe of the rickety-rockety kind.

Anyway, congratulations to Mr. Lamb on his quick and successful job, and good luck to the second attempt which he is now starting.

Ruminations on the Road

Sometimes, when making a long non-stop run on my little railway, my mind wanders back, perhaps over the years, or maybe I ponder over some of the problems that beset the builder of *real* little locomotives, recall incidents that have happened in my own personal experience, or compare the experiences of others, with my own. It so happens that just recently I was making a run of about three miles, doing a bit of experimenting, for the future benefit of the good folk who follow these notes. Towards the end of the run, I found that the seat was—well, beginning to feel a trifle hard, shall we say?—and I recalled an article which appeared in this journal on driving positions. This weighed up the pros and cons of the sitting, kneeling, and lying-down attitudes adopted by drivers on ground-level roads. Different people, of course, have different fancies; it would be a tame sort of world if everybody thought alike, and each driving position has its advocates. However, it seems to your humble servant, that out of bed, the most restful position, or perhaps I should say the least fatiguing one, is sitting; but this requires a qualification. Nature provided us all with something to sit upon, and our legs and feet should

be below that level, for comfort; anyway, it said so in the book on human physiology which I studied in my young days, by way of variation, as I wanted to learn all I could about the "human locomotive" as well as the mechanical one. Incidentally, I gained a first-class certificate in the advanced section, and the examiner said I should have entered the medical profession. Can you imagine Curly with a red lamp over the gate—I should have whistled for it to turn green every time I went out! However, according to that, the kneeling and prone positions would appear to be physiologically (good word that) wrong, and so would the sitting position when, as "1121" aptly put it, the sitter "imitates a grasshopper."

Ergo, as the old actor would say, a small railway should be elevated so that the driver of the engine can sit behind her with his legs below rail level, in a natural position. Whether he rides astride or sits sideways, is a matter for his own choice. I always ride like Lady Godiva, though not in the same costume; and apart from the little trouble mentioned above, on a long run, I do not feel the slightest discomfort. Most drivers of small engines of 2½-in. and 3½-in. gauges, prefer to ride astride, but this needs footboards. It is, as a matter of fact, a risky thing to ride astride on a narrow flat car with unsupported feet; any doctor would tell you why. Personally, I should say that an astride rider would be most comfortable on a bicycle saddle, with foot rests set at the right height to suit his stature.

The most natural position I ever saw for the driver, on a ground-level line of 3½-in. gauge, was over in U.S.A. The line was a mile long, laid out like a full-sized American railroad, complete with all accessories, including a five-road roundhouse with turntable complete, and a typical trestle-bridge. There was a loop at each end, so that you could "keep on keeping on till the cows came home." I did five miles over it on one occasion. The owner was a tall man with long legs. On the front end of each tender, very low down, were two foot-rests; and the owner sat on the end of the first car, as close to the tender as possible, and stretched out his legs each side of it, with his feet on the rests, just like a cyclist coasting in the days before free wheels were invented. His body was thus free to move in any direction; he could reach anything on the footplate without losing balance, and had perfect control over the engine. Even if I could have "straddled," my legs were not long enough to reach the foot-rests, so I always sat on top of the tender; but it wasn't very comfortable.

There is another point regarding driving positions and that is, distribution of weight, to avoid overloading any particular axle, and causing excessive flange friction. My weight, in proportion to old "Ayesha," for example, is equal to 27 coaches; and no engineer in his right senses would put that load on four axles, in full-size practice. Unfortunately, we have no alternative; so the only thing to do, is to see that the load is evenly distributed. I find it best to use a flat car with the bogies spread just far enough apart, to allow me to sit between them; and I sit far enough over, to keep even pressure on both rails. The few friends who have ridden on my road, haven't always managed to do the same; and it is quite easy to prevent an engine starting at all on a curve, by sitting over one bogie and having your weight all one one side, so that the two wheel flanges are literally jammed solid against the railhead, like brake blocks against a wheel. For drivers of short reach and stature, I shortened my old original test car, so that both bogies are under the rider; and on one occasion Driver Earl drove "Annabel," the Mallet, for four miles at high speed on this car without any discomfort or derailment. He thoroughly enjoyed himself!

Exhibition Paint-work

MR. R. PEMBLE writes :—"Arising out of Mr. R. H. Procter's letter in THE MODEL ENGINEER, September 30th, even supposing the average model engineer can obtain a good finish when he has painted his model, it is odds-on that he will ruin the work when it comes to lining and lettering. This can be made to look "after the rate" by using transfers I will admit, but even these are difficult to obtain in many cases, and with fingers that may be dexterous enough with engineering tools, this method, too, can present enormous difficulties, as models being so much smaller than the original have many inaccessible corners and angles.

"Lettering and lining is an art in itself, equal to that of constructing models, and my advice to any modelmaker desiring his model to be lined or lettered, is to hand it to someone who can do justice to the work already put into the model, and ask him to help; if not, get the job done professionally.

"There are plenty of books in circulation giving every instruction possible, but unless a person has the capability, all the reading in the world will not give the results required.

"I am not a model engineer in the strict sense, but I do happen to be able to assist some of our own members in this particular direction, and can, therefore, speak with some confidence.

"I may not have been of much assistance to Mr. Procter, but I do hope that model engineers will leave their models in all their perfection, and not spoil that evidence of patience, grand workmanship and loving care with clumsy attempts at doing something they should never have attempted."

*Rocket Propulsion

by D. Hurden

HAVING shown to what point rocket development has been carried, let us now see what part has been and is being played by amateurs in the field.

Once the possibilities of liquid-fuel rockets were realised, experimental work on a small scale began in Germany and America, but, for reasons which will appear later, Britain took little part in this early development.

In 1923 interest was stimulated in Germany by the publication of a comprehensive treatise on rockets by Hermann Oberth, and groups of amateurs were encouraged to begin practical work. In 1927 the " Verein für Raumschiffahrt " (Society for Space Travel) was formed, and about three years later members of this society built and fired a number of small rockets burning alcohol or petrol and liquid oxygen. Most of these rockets were made with thin metal combustion chambers cooled by surrounding them with liquid. The earlier types were built into a small tank of water and later types, which were actually launched, were cooled by the same method except that the rocket was built into one of the propellant tanks instead. A diagram of one of these early German rockets appears in Fig. 1. In 1933 the work of this society attracted the attention of the military authorities who took over its control, whereupon the members lost their amateur status and became the nucleus of the group that eventually designed the V2.

In America as far back as 1923, Goddard had made a rocket which burned petrol and liquid oxygen, and in 1925 he succeeded in building a projectile powered by a small liquid-fuel rocket. In contrast to the German designs, this motor had an uncooled combustion chamber lined with a refractory material. In 1930 the American Rocket Society was formed, and members of this group carried out much useful research on small motors. Some of their designs were liquid-cooled and resembled German practice, but they developed a motor, shown in Fig. 2, which used an entirely different method of cooling. This motor which was built up from blocks of aluminium which, having a considerable heat capacity, were able to absorb the waste heat from the combustion gases and thus allowed the motor to run for several seconds without overheating. Motors built on the " heat-sponge " principle have since been used in units requiring thrust for short periods only. The society has built numerous other rockets, many employing regenerative cooling.

Several other American societies have been formed, one of the most recent being the Pacific Rocket Society whose Douglas Fir Rocket is sufficiently ingenious to deserve special mention. Faced with the problem of making a cheap and expendable booster unit to assist the launching of a larger meteorological sounding rocket, members bored out a billet of fir wood, fitted it with a liquid oxygen injector and a fire-resistant nozzle, and performed the equivalent of " lighting the blue touch-paper." The first two logs lost their nozzles immediately, but the third, shown in Fig. 3, behaved so vigorously as to upset its test stand, having exerted a thrust of some 50 lb.

The British equivalent of these organisations is the British Interplanetary Society founded in 1933, whose journal contains much information on rockets, as well as on interplanetary travel. Members are not, however, as fortunate as their fellows in America, since amateur experimental work on liquid-fuel rockets in Britain is forbidden by the Home Office, presumably because an experimental worker might easily do himself

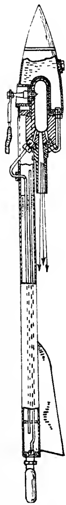


Fig. 1

**Continued from page 557, " M.E.," November 25, 1948.

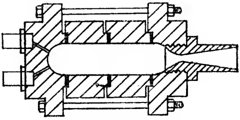


Fig. 2

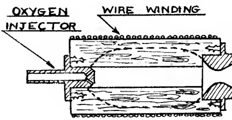


Fig. 3

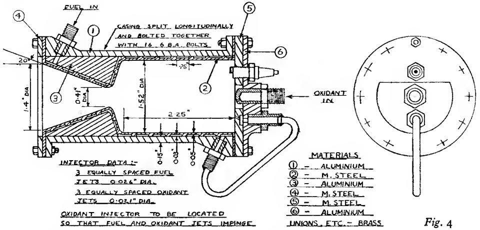
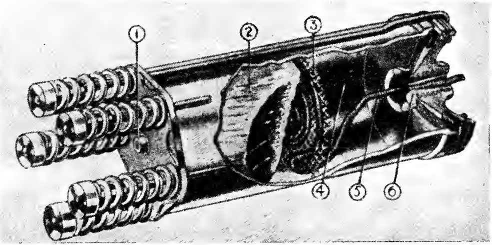


Fig. 4

and his neighbours grave damage by making a foolish mistake. It is rather hard that those amateurs whose qualifications admit them to a society, formed to extend our knowledge of rockets, should be prevented from doing active research in a suitable place and under expert supervision. However, such is the law, and at present the British Interplanetary Society is forced to confine its attention to theorising and other less hazardous pursuits.

The ban on firing small rockets is unfortunate, since the manufacture of a small combustion chamber of modern design would present many interesting problems to a model engineer. It is, of course, possible to make a demonstration model and devise a control system whereby water can be forced from the " propellant " tanks into the combustion chamber at the touch of a switch, or it is possible to make a small combustion chamber simply as an exercise in craftsmanship. A sketch of a possible design is presented in Fig. 4, on which the most important dimensions have been marked as a guide. It may be noted in passing that a chamber of this size could give a thrust of the order of 10 lb. The most striking piece of machining involved is the helical passage through which coolant would normally circulate. The object of this is to force the coolant to take the longest possible path through the cooling jacket and so to acquire a fairly high velocity which is conducive to good cooling. It will be seen that it involves the machining of a helical ridge of varying diameter which may be undertaken in several ways. The inner shell could be machined from the solid and the helical passage turned on the outside. The writer has seen a chamber made in this way, but the machining would be no mean problem. An alternative, but no less tricky, method would be to wind wire round the outside, and braze it to the chamber, and then to skim the whole affair so that it fitted snugly inside the outer casing. It is important that the clearance between the helical ridge and

(*Continued on page* 617)



The " Jetex " model aircraft rocket

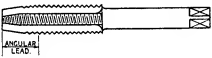
FORMING SCREW-THREADS

by A. N. Appleby

ONE of the most prevalent practices in engineering is the forming of screw threads whether external or internal, and it is also amazing the number of methods that are available to modern engineering when one begins to study and give thought to the subject.

The production of tools to control the operation of forming screw threads is considerable, inasmuch as firms have been encouraged to specialise in this equipment, in order to meet the demand required by the industry and to supply very large quantities.

This article is, however, intended to give a brief reminder as to several of the best and, perhaps, some of the least-known of these methods, so that a refresher may be afforded to those who know, whilst an enlightening education will be available to those who have not experienced, or come in contact with, the methods herein referred to.



Hand tap for general purposes. Angular lead is shown and square on end

In any screwing operation, each job must be planned on its merits, for a method suitable for a high precision job would be totally out of place for a general production job; also, the type and quality of the metal to be cut must receive due consideration, and, above all, cutting times must be reckoned with as this might have the effect of influencing the considered method.

Quality as opposed to quantity is another feature to be considered, for the formation of screw threads must be produced giving trouble-free assembly with exacting operation in line with engineer's specification.

It will be agreed, therefore, that according to the specification, the technique of production of the thread varies and so all attention must be paid to this point, in order that cost and speed of production falls in correct phase.

It is admitted that ideas as to actual form or shape of screw threads for varying purposes differ from country to country, also that the elements of the thread may be quoted in either English or Metric; but whichever form or whatever system, the methods of producing the threads are the same.

The secret of all thread forms lies in the tools from which the thread is made and again as methods differ, likewise the tools, according to the requirements of the job in question, and whether it be an external or an internal thread that is required, or finally, whether the quality of the thread demands the observance of limits usually associated with Grade "A" threads to give the required performance in assembly.

It is the purpose of this article to discuss and consider many of the varied tools and methods usually applied to the production of screw threads.

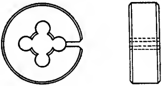
Taps

Perhaps the first tool which comes to mind is the tap, for this tool is used for cutting internal threads in a hole, which is first produced by a drill or other boring methods.

Taps are produced by one of two methods known as "cut thread" produced in a lathe, or "ground thread" produced by a special machine tool.

Taps are commonplace in any engineering establishment and are stocked in standard range and loaned from a tool store.

The construction of a tap is not very hard to understand when it is realised that it consists of a thread form produced on the outside diameter of a tool-steel blank or billet, the replica of the form it is required to cut internally; then flutes are cut parallel to the axis, thus forming a cutting tooth or teeth, and finally subjected to heat treatment and hardened.



Solid die to be used in a wrench or adaptor

The cutting propensities of the tap are exercised by offering the tap to the pre-drilled hole and with a turning action with forward pressure, the tap is trailed into the hole, thus producing a thread internally in the hole.

Taps are usually made in sets of three, each one in turn making the screw a little deeper, for No. 1 has a tapered lead, produced by taking the crest of the threads of the tap to a diameter slightly smaller than the core diameter of the thread at the entrance end, thus permitting the forward end of the tap to enter the pre-drilled hole before turning and trailing begins.

No. 2 tap has not quite so much length of taper, whilst No. 3 is a bottoming or plug tap which has an equal amount of thread the full length of its screwed portion.

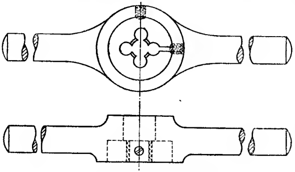
Pressure to start the tap may be applied by hand, the tap being held in a wrench locating in a square hole which takes the square end of the tap, or it may be fed by the pressure of the spindle of a machine, an adaptor taking the place of the wrench, these two methods are frequently employed.

Dies

If an external thread is required, then a convenient method of screwing is carried out by what is known as a die.

The die is much the same in method as that of a tap, except that the elements of screwing are reversed, that is to say, an internal thread is formed on the inside of a hole in a piece of cast steel, corresponding to the size of thread required on the work-piece, and this is suitably fluted, as seen in the sketch, to produce a cutting tooth which is then hardened.

By holding the die in a holder, known as a stock, and applying pressure axially with a clockwise turn, the die is trailed over a pre determined diameter, thus forming an external thread.



Solid die assembled in a wrench, showing methods of adjustment by Allen screws

In both cases, either a tap or die, right- or left-hand cutting can be achieved according to which is required, then, of course, the action described would be reversed.

As in the case of the tap, so follows the rule that a die may be hand or machine operated, according to design requirements and planning.

The number of cutting edges in the die are usually four in number, but if the diameter is large enough, six may be preferred, as with six the cutting qualities are improved and the balance of the die over the axis of the work-piece is better controlled in operation.

Dies are made either solid or segmental, and adjustment is more readily achieved by the latter method, although, within the spring of the material from which a solid die is made, sufficient adjustment can usually be afforded by providing a split in the die. An efficient closing method is found by means of a screw, applying pressure on the periphery, whereas with segmental dies, the segments can act as jaws and can be advanced by applying pressure on the outer edge of the segment.

Apart from closing the die by the means so described, it is often necessary to afford adjustment in the opposite direction, for it is sometimes a useful thing to produce a tight thread, such as the tight end of a stud, the opposite end being free to satisfy a standard nut.

In order to open the die slightly to give this oversize diameter, pressure can be applied by arranging the point of an Allen screw to engage in the split and this will expand the die.

To give the die the necessary start on the work-piece, the die is held in a holder with extended handles, called a stock, and by this stock, hand pressure can be applied; or if it is desirous to operate the die by mechanical means, then the die is held in a collet of suitable design and fed on to the work-piece, the screw being formed by trailing. In practice, the die has several uses such as screwing small diameter parts, or it is found useful for putting on the crest of a thread after being struck with a single-pointed tool (a method to be discussed later), or dies are used for sizing plated or coated parts before assembly, a practice often required to remove offending particles of unwanted material.

Chaser

Times have changed considerably since the days of the hand chaser and in cases where the limits of the thread are not important, or where a thread is simply used as a means of travel, then the chaser is found to be quite a useful tool.

It would, however, be well to state that chasers, properly controlled, are used at their best for the production of the finer threads or for slow-moving helix angles on the thread to be produced, for it is realised that the helix angle changes with the diameter of the thread and on some of the modern chasers, adjustment of this is provided for.

Several years ago the hand chaser was a common tool in engineering and in the hands of a skilled workman these were very useful in the formation of screw threads. The chaser consisted of a piece of steel, say $\frac{3}{4}$ in. × $\frac{3}{8}$ in. section, with a series of thread forms machined on the end and these thread forms were each made cutting edges by grinding a top rake.

At the opposite end, a tang was formed which fitted into a long wooden handle, and this was held against the shoulder of the turner in operation, whilst the tool rested on a tool rest similar in appearance to the rest on a wood-turning lathe, the tool being travelled by skill over the revolving diameter of the work-piece, thus cutting the thread.

Since those early days, screwing by the use of the chaser has become more mechanised, and chasers are now travelled over the work-piece by a geared pitch corresponding to the pitch of thread to be cut, whilst the chaser is secured in a tool box as for a turning tool set at the correct height. It is in this modern method that provision is made for adjustment of the helix angle according to diameter or pitch of thread.

There are many products in engineering where the chaser becomes a very desirable tool and it is usually employed on the non-ferrous or softer material; I refer to such components as camera lenses, adaptors, pipe connections and other loose fitting threaded products, or on the other hand, tight threaded parts which require a thread as a means of travel, or, as in the latter case, an interference fit.

The maintenance of the chaser is a simple operation and is usually confined to the grinding

of a top rake and then resetting in the machine to the axis centre-line height.

A chaser may only have one thread form with two crest-forming radii and with this type of chaser, it can be fed gradually into the work and very precise threads can be formed both internally and externally.

Die-heads

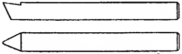
A die-head is a combination of four chasers of multiple thread forms and set to cut the required diameter, whilst a stop is arranged at

centres in the lathe and is revolved at the appropriate speed, whilst the saddle of the lathe is geared to traverse at the relative speed according to the pitch of thread that is required to be cut.

One of the advantages in this method of lathe screw-cutting is that the length and diameter of screw thread to be cut is limited by the size and capacity of the lathe ; but the scope is very much enlarged, as by a change of gears in relation to the lead screw, almost any pitch of thread can be attained.

With all screw-cutting lathes, that is to say,

Hand chaser used by brass finishers and operated by skill



External screw-threading tool to afford adjustment of helix angle

the end of the trailing period which in turn operates a release cam which opens the chasers to a diameter greater than the work-piece stock, which enables the die-head to be withdrawn and travelled back without cutting.

Such tools are used on capstan or turret lathes or on automatic machines.

There are three types of die-heads which might be mentioned, the rotating, the non-rotating, and the floating, this latter following the truth of the work whilst cutting.

The die-heads operate as follows : Where the work is revolving, a non-rotating die-head is used, whilst the reverse is the case where a rotating die-head is used, for in this case the work is stationary ; in the third case, the head is designed to oscillate with the truth of the work-piece, a condition often prevailing where castings are concerned.

The chasers used in die-heads are usually of the tangential type and as such the rake cutting angle differs according to the metal to be screwed, and it is also recognised that this tangential type of chaser has a good life and offers an easy problem for sharpening, as all that is required is to sharpen the rake angle by grinding.

After each sharpening, the die-head chaser requires to be reset, and the adjustment is afforded by sliding the chaser along the tangential groove before tightening, after trial and error.

It is important that the rake angle is maintained according to the metal to be cut, for a change in this angle is likely to cause interference with the passing of the screw gauge, for actually the thread form would be changed.

In resetting the chasers in the die-head it is important to see that the point of the chaser is on the centre-line of the work in order to preserve smooth cutting.

As a study in economy if the chasers are rake ground at the opposite end, it is often possible to reverse the chasers in the allotted groove and so save costs if a left-hand thread is required.

Single Point Cutting

Screw-cutting on the centre lathe is an old-time practice and as a matter of fact has not as yet been superseded, although methods and tools have been considerably improved.

The work-piece is held in the chuck or between

lathes which possess a lead screw and traverse mechanism, a full set of change-gear wheels are supplied, which are suitable for determining the various pitches of thread and this combination and its true relation to the lead screw pitch, will traverse a helix on the work-piece as the tool of the correct form of thread is brought into contact by gentle cuts, until the correct depth of thread is reached, according to the elements of the screw thread to be cut.

In this operation of screw-cutting, all attention must be paid to one or two factors, if precision and elements of the screw thread to be cut are to be attained and retained.

In the first place it is important that the pitch of the lead screw of the lathe is approved to the recognised standard, and secondly, that the form of the cutting tool is correct and approved, whilst thirdly, it is important that the point of the cutting tool is set in the lathe to the axial centre-line of the work-piece and at a turned slope which will clear the helix angle of the thread being cut.

These factors in the production of precision threads, need to be carefully studied if screw threads of the required accuracy are to be produced, and perhaps the factor needing or calling for first priority in this connection is the forming of the thread-cutting tool and its cutting rakes, according to the type of material to be cut. I would suggest that this is done mechanically, as far as possible, in a jig provided solely for the purpose, to give correct angles and symmetry, whilst the entrance radius is formed by the toolmaker, the whole being projected against a template of many magnifications and approved.

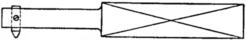
If this forming of the cutting tool can be relied upon, then in production the core or minimum diameter of the screw will be the only measurement required as a preliminary check. However, a second operation will be necessary to complete the thread, for as we have seen the crest at the core or root diameter is automatically formed, a corresponding radius is required at the crest on the major or outside diameter of the screw.

This crest radius is formed by a separate tool depicted in the sketch and the radius is blended into the angular sides or flanks of the thread, as they are called.

For internal threads, the principle of thread forming by this single point method is not interfered with, the only change is that a boring tool is used instead of the outside turning tool.

The boring tool and its shape needs a little study for it will be realised that as with external threads, the helix angle is " changeable " according to the diameter and pitch of the thread to be cut, and attention must be paid to the necessary tool clearance so that the next thread is not fouled in any way.

In order to guard against these possibilities, the writer suggests that the boring tool is produced from round section tool steel and a vee piece used in the tool box, so that by turning



Internal threading tool, which offers adjustment for helix angle

the tool before clamping, all diameters and pitches can be catered for, and also right- or left-hand cutting can be accomplished.

The thread is formed on the work-piece by a series of passes of the tool by geared traversing, and each time the depth of thread is increased until the full depth is reached.

After each pass, it will be necessary to withdraw the tool and if the relation of the pitch to be cut to the lead screw is a multiple, then the saddle can be wound back to its starting place by hand and this will save a good deal of time.

On account of preventing any pitch error, it is advisable to use the same portion of the lead screw in each pass, and this matter will require interest and attention to accomplish.

Multiple threads can be cut by this single-point tool method by cutting one thread at a time, then spacing the subsequent threads by dividing the teeth on the change gear by marking the meshing tooth with its companion gear, lowering the swing plate and adjusting the wheels by turning to the next meshing tooth thus marked.

A study of relative speeds in conjunction with various metals is required, and experience is the best teacher in the solving of this problem, but in the case of coarse leads causing very obtuse helix angles, it may suggest the employment of a speed reducer, which provides for a 6-1 reduction and this attachment is supplied to the better modern lathes.

This speed reducer and its application enables coarse pitches, Acme and worm threads, buttress and square threads to be cut with comparative ease.

By reversing the lead screw and its relative passes, left - hand threads can be produced, cutting, of course, commencing at the fixed headstock end of the lathe.

Screw Thread Grinding

Owing, very largely, to the recognised improvement in precision and surface finish, also the trouble which often arises in heat treatment, special machines have been designed in order that grinding may supersede the tool cutting method and particularly with regard to the possible distortion, after heat treatment, on such products as taps, grinding the thread has much to recommend it, for it will be seen that the thread can be formed direct from the hardened billet, thus defeating the distortion which is likely if the operations were reversed.

With regard to the form of thread, this is controlled by a diamond dressing of the wheel automatically transferred from a copy-plate of some 15-1 magnifications, for this is followed by a stylus, thus reducing thread form errors to the minimum.

The principle of thread grinding is precisely the same as for thread cutting, in so far as the work-piece revolves whilst the formed wheel traverses to a given pitch which is controlled by a ratio of gear wheels to the travelling lead screw, whilst the operation of cutting the thread is controlled by the element of skill, and this takes care of speeds and feeds, wear on the grinding wheel, the redressing of the wheel and resetting the cut.

The construction of the thread grinding machine provides added advantage where the production of taps is concerned, for by a cam arrangement, a movement of the traversing table at every flute of the tap is so arranged to give a slight relief, the result of which affords the cutting propensities of the tap in action to be freed from binding and consequent breakage.

Some thread grinding machines are provided with a broad grinding wheel which has a series of thread forms produced on the cutting surface by a special auxiliary machine called a thread crusher, and the advantage of this development is to economise in the wear of the wheel and the consequent wheel dressings, whilst this type of wheel will compare very favourably with normal production times when studs, bolts, or shafts are required to be screwed in quantities; and of course the finish of a ground thread is very good quality, for a good finish prolongs the life of the thread in question.

Internal threading can also be accomplished by thread grinding, but this, though suitable for

Thread crest-forming tool as following operation to the single-pointed threading tool

certain quality jobs, does not strike the same note of popularity.

Both single and multiple threads can be produced on the thread grinder, but coarse pitches offer a problem as the helix angle often interferes with the next thread form owing to the size of the grinding wheel diameter.

Thread Milling

A further method of thread forming is performed on the thread milling-machine and this method is invaluable for the production of long commercial screws and the like.

The method is also useful for the production

of heavy - duty threads such as Acme, worm, or buttress forms, and the rapidity of production is amazing provided adequate chucking arrangements are available and the operation is semi-automatic, relying on the formed cutter for the thread form.

Intermittent threads can be produced by this means and the method is often used for taper threads with uniform accuracy, and where multiple threads are required, gang milling cutters can be set up to satisfy the number of starts.

A feature of thread milling is its universality for external or internal threads, coupled with production times, for the thread miller takes the whole depth of form in a single cut and this time saver presents a great attraction.

Where the production is rings, adaptors and all types of loose fitments and thread is used as a means of travel, internal thread milling has much to be recommended.

Hobs for this purpose can be stocked, and these are not threaded forms but a series of annular thread forms which are travelled into the work-piece by the use of a ratio of pitch gears, whilst maintenance of the hob and its consequent sharpening is done by grinding the leading thread up to a full form.

The universal milling machine can be adapted for thread milling; but if quantities in production are considered, it is best to go in for a machine designed for the purpose and advantage taken of its robust construction.

Thread Rolling

A rather old method of thread forming has been resuscitated in recent times with a good percentage of success, — I refer to thread rolling.

It will be agreed that on materials of the non-ferrous type and also on soft metals such as mild steel, a thread can be raised on the surface by passing the work through a pair of threaded rollers and so forming by pressure the desired form of thread.

The blank, billet, or stock, must of course be of requisite diameter to provide sufficient material to be raised to the full form of thread desired, and it is usual to consider that where solid threads such as bolts, studs, wood screws, etc., are required, a stock diameter equal to the pitch diameter of the thread to be formed, will be a good guide in this connection.

This process or method is very economical where tubes are required to be threaded ; such examples are electric lamp bulb caps, caps for bottles, screwed sockets and the like, for here there is no wall thickness and this is probably the only way to solve this problem of threading.

A further feature of this thread rolling of tubes is that owing to the equal amount of raising and depressing of the thread, it enables the thread to be used internally or externally whichever is required and without any change of tools for the process.

Thread rolling is automatic and depends exclusively on the setting of the machine, and on account of this, heavy quantities are desired to offset setting times.

This process of thread rolling produces a very good thread both for size and finish after the pressure required has been adjusted by trial and error and thread rolling can be recommended to make a good commercial job in the minimum of time.

Conclusion

Besides the methods of screw thread forming here mentioned, there are still many more developments which have not been touched upon, and here I refer to the automatic tapper, machine chasers for internal and external threads, adjustable taps for large holes, with removable jaws for sharpening by grinding, shell taps and others. The article is intended to convey the principles of thread forming and each method would well serve as a title for an individual article; and so I conclude in the hope that sufficient has been said to whet knowledge on thread forming devices and that the thirst for such knowledge will create an added interest in the wide field of engineering.

Rocket Propulsion

(*Continued from page* 612)

the casing should be small, otherwise coolant will "short-circuit" from one passage to the next and so defeat the object of the device. A third method which will appeal to those who enjoy patternmaking is to reverse the practice described so far and cast the outer casing, helical passage and all, in light alloy. The top surface of the ridge, which will be in contact with the inner shell, has still to be machined, however, so this method is not much easier than the other two. The rest of the machining is fairly straightforward, whichever construction is favoured.

The nearest approach to a working miniature rocket motor available to the British public is the "Jetex" power unit illustrated in Fig. 5. It is a commercially-made solid-fuel rocket which appears to be eminently suitable for mounting in model aircraft, since it is made in sizes down to 1 in. diameter and less than 1 oz. in weight. A motor of this size develops about 1 oz. thrust for 20 sec. and appears to be incapable of blowing up, since a sudden rise in combustion chamber pressure would simply push out the back of the motor against the loading of the four springs and so release the pressure harmlessly. Until model engineers are allowed to build their own miniature rockets, it is with units like this that model aircraft must be powered ; but, efficient as they may be, there are many who will miss the pleasure of making and developing their own power plants.

A Dividing-Head for the Lathe

by H.C.W.

THE excuse for yet another article on dividing-heads is that the way in which they can be made up simply to do a satisfactory job will vary from one lathe to another, according to circumstances. Consequently, there are many methods of doing the job, and the one the home mechanic will select will be the result of what others have done before him, applied to his own particular lathe, plus any ideas he can add to suit his own problem.

In the present case, it all started with the finding, among a lot of ex-service gear, of a brass condenser dial graduated 0-360 deg., which seemed to be a useful sort of thing just crying out to be put to some good purpose. The idea of a dividing-head came from a current article in THE MODEL ENGINEER and the whole thing grew from that.

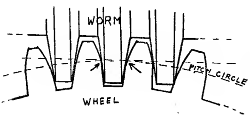


Fig 1

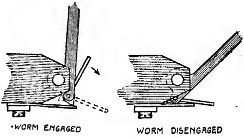


Fig. 2

Primary Considerations

A dividing-plate fixed to the back end of the headstock mandrel may be useful for some purposes, but a number of plates will be required, and then it may happen that an odd job turns up for which no plate is available. It seemed that a universal dividing-head, which would cater for any number of divisions, while having certain more common divisions pegged off for convenience, would be more satisfactory, and it was decided to use the large back-gear wheel on the headstock spindle as the basis of division.

Acc urate Tooth Spacing

It must, of course, be realised that the subsequent dividing mechanism, however well made, cannot be more accurate than is the tooth spacing on this wheel. It is not likely that any trouble will occur from this cause however, since most lathes of repute have their gears machined on an accurate dividing-head. In a number of jobs carried out on my own lathe, using this attachment, from small gear wheels to index plates and scales, I have not so far detected any irregularities attributable to this cause. The first job then is to machine a worm which will engage with the back-gear wheel. To do this, it will be necessary to decide on the circumferential pitch of the teeth on the wheel, and the form of teeth on a rack that would mesh with it. This will produce a worm of "Acme" form, and a tool should be ground to suit. The final cuts should be made carefully, because the accuracy of the finished device will depend on the truth of the worm. Slow speed, a sharp tool and plenty of suds is the secret of fine finish on steel.

Helix Angle

It will, of course, be clear that, for the thread of the worm to engage correctly in the teeth of the wheel, the worm must be set at an angle equal to the helix angle θ which is given by the formula :

$$\text{Cot } \theta = \frac{3.1416 \text{ d}}{\text{L}}$$

where θ = helix angle, d = pitch diameter of worm, and L = lead of worm. The worm should be cut and the end journals turned between centres. The worm thread must also be cut in such a way that there is no danger of the teeth of either bottoming in the other. The worm must be cut deeper than the gear so that the contact between the two is always on the pitch circle. See Fig. 1.

Method of Attachment

Some means of holding the worm securely in contact with the wheel should next be considered. In the case of my own lathe, a Zyto, this could best be accomplished by fitting the worm in two plummer-blocks attached to a backplate, which was hinged at the lower end to a block attached to the lathe bed.

The bottom overhang of the backplate carries a trigger bearing on a spring steel strip which provides the pressure for keeping the wheel and worm in mesh, see Fig. 2. When the trigger is depressed, the pressure is released and the worm is free to drop back clear of the wheel. The whole worm bracket can be removed by withdrawing the hinge-pin.

The top of the top plummer-block carries the

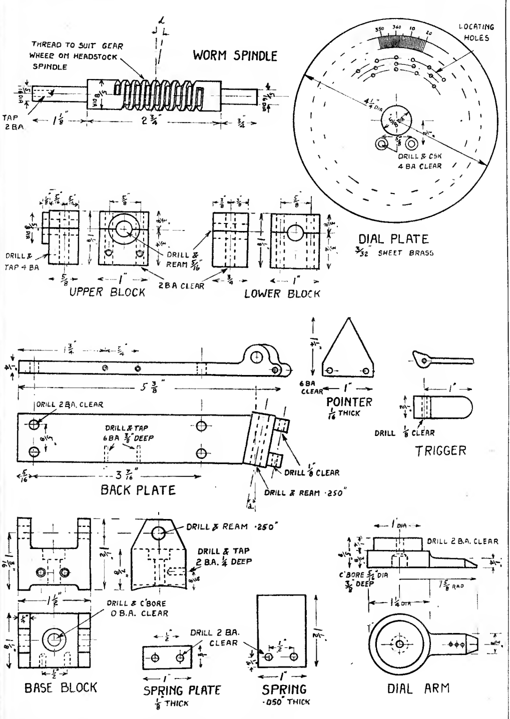

WORM SPINDLE
THREAD TO SUIT GEAR WHEEL ON HEADSTOCK SPINDLE
TAP 2 BA
LOCATING HOLES
DRILL & CSK 4 BA CLEAR
DIAL PLATE
3/32 SHEET BRASS
DRILL & TAP 4 BA
DRILL & REAM 5/16
2 BA CLEAR
UPPER BLOCK
LOWER BLOCK
6 BA CLEAR
POINTER
1/16 THICK
DRILL 1/8 CLEAR
TRIGGER
DRILL 2 BA. CLEAR
DRILL & TAP 6 BA 3/8" DEEP
DRILL 1/8" CLEAR
DRILL & REAM ·250"
BACK PLATE
DRILL & REAM ·250"
DRILL & TAP 2 B.A. 1/4 DEEP
DRILL & C'BORE O B.A. CLEAR
DRILL 2 B.A. CLEAR
C'BORE 5/16" DIA 3/8" DEEP
BASE BLOCK
DRILL 2 BA. CLEAR
SPRING PLATE
1/8" THICK
SPRING
·050" THICK
DIAL ARM

Fig. 3

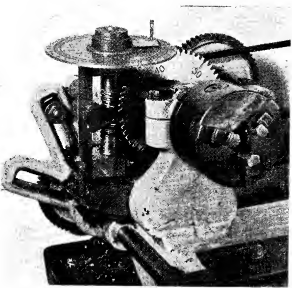


Photo by] [*Eric Meyer*

Dividing-head in use

worm firmly in contact with the headstock gear-wheel.

Divisions

Three holes were drilled in the indicator arm to take the dowel peg, and when the whole unit was assembled, the indicator arm was clamped in the various positions according to the scale reading, which was set with a magnifying glass, and the dial holes were drilled at 24th, 20th and 18th intervals for the respective circles. These cover the most likely divisions which may be required and any others can be worked out from the formula :

$$\text{Deg. per division} = \frac{360 \times 60}{\text{No. of Divisions}}$$

and set out by the divisions on the outer scale.

Provided care is taken with the construction, this dividing-head will be found to give complete satisfaction for all kinds of work for which it is suited.

condenser dial aforementioned. The plummer-blocks must be fitted carefully and there must be no end-play of the spindle between them.

Marked Back-gear Wheel

On the lathe in question the back-gear wheel has 60 teeth and these have been marked off in tens to register with a pointer attached to the backplate. Depending on the amount to which back-lash has been eliminated, the device will divide to 60 $\times$ 360 parts. A series of holes is provided for pegging the more common divisions, but any division can be worked out and set accurately by the dial.

Constructional Details

The rest of the construction can be followed from the details of Fig. 3. It is as well to face up the four parts for the plummer-blocks separately and drill them to take the 2-B.A. screws. They can then be bolted together in pairs and the journal drilled and reamed in the 4-jaw chuck.

There will be a certain amount of fabricating with an oxy-acetylene torch to be done in the case of the backplate and the base-block, though it may be possible to redesign these parts to obviate the need for welding if this presents any difficulty. The trigger spring was beaten out of an old car spring by my friend, the blacksmith. It should be strong enough to hold the

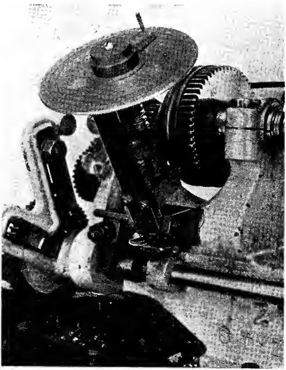
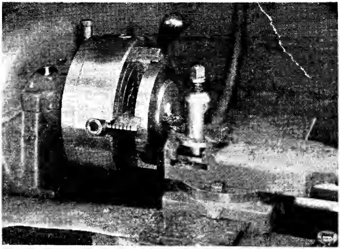


Photo by] [*Eric Meyer*

Dividing-head released

Adapting a Vertical Slide

by H. Charnley

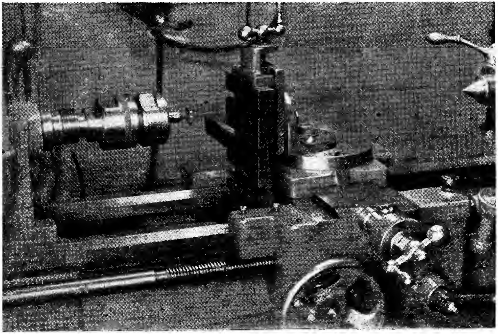


A carbide-tipped tool taking a heavy cut in cast-iron

SOME weeks ago, I sold my old lathe and invested in a new one, but although this is an excellent job, and capable of both heavy work and precision work, the saddle and cross slide is not so adaptable as my old machine, as the cross slide is designed to hold only the compound rest, whereas I have been used to having a boring table on the cross slide.

When I mount my milling-slide in the slot which normally holds the tool-holder, its movement is somewhat restricted. The piece of work shown on the four-jaw chuck in the first photograph is a cast-iron fixture I made to bolt on to the cross slide in place of the compound rest, on which I am able to bolt to the milling-slide. When I first made this platform, it had a boss on it ½ in. high. Having to bolt my slide on this boss still restricted its movement so I decided to make the platform of one uniform height; the photograph shows this boss being turned off, using carbide-tipped tool taking a 3/32 in. cut on the cast-iron.

The second photograph shews this cast-iron platform with the milling-slide mounted on it.



Editor's Correspondence

Fusible Plugs

DEAR SIR,—With reference to the article by Mr. F. Cottam, on "Fusible Plugs for ¾-in. Scale Locomotives," in the November 11th, 1948, issue. He states :

"When the water-level is allowed to fall below the firebox crown, the rush of steam into the firebox damps down the fire and may prevent the firebox crown from overheating and collapse."

As a driver on the British Railways (N.E. Region), I have always been under the impression that the fusing of a plug was to reduce boiler pressure and prevent the possibility of a boiler explosion.

Yours faithfully,
Northwich, Ches. B. H. MATHERS.

Steam Ploughing Engines

DEAR SIR,—The photograph reproduced on this page is of a pair of single-cylinder ploughing engines which were, until a few years ago, working some very heavy clay land.

It will be noticed that the steering-wheel shaft is mounted in a vertical position on the tender and, in this particular case, the steering is by means of a wire cable instead of chain.

There were no numbers to be found on either engine, but cast on the firehole-door was the name, "Oxford Steam Plough Co., Cowley, Oxford." I should think these two engines were built well back in the last century; perhaps, some of our older readers may remember this make of engine.

John Fowler & Co., of Leeds, were the best-known for their ploughing sets, although Aveling & Porters, also McLarens, did manufacture some sets. I have seen a set of Aveling's compounds at work pulling a five-furrow plough on heavy land, and on the same land I have seen Fowler compounds at work. The Avelings had a rather larger diameter of boiler and a shorter smokebox than the Fowlers.

I saw a very fine set of Fowler tackle pass our works the other week, a sight not very often seen these days, worse luck.

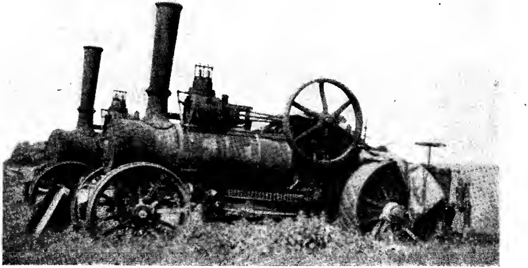
I hope this letter will be of interest to readers, and that this subject of traction engines will continue.

Yours faithfully,
Folkestone. R. WEST.

Hot-air Engines

DEAR SIR,—I have just read the article on "A Successful Hot-air Engine" by Mr. Messer, of Australia, and I was most interested in same. I should like to offer answers to the two questions appearing at the end of the article.

(1) The Heinrici engine which I once owned was quite indifferent to the jacket temperature. It ran equally well with cold water or boiling water; or again with the jackets dry. As the main purpose of the jacket in an engine of this type is to assure some approach to the isothermal during the compression stroke, it is conceivable that with cold water in Mr. Messer's engine, too much heat may be abstracted—especially if the engine runs slowly—leaving the air unduly chilled at end of compression and requiring more heat for expansion that can satisfactorily be transmitted.



(2) Slowing down was experienced with the Heinrici in exactly the same manner as described by Mr. Messer. This was due to gradual loss of air from the cylinder, and was cured by suitable attention to the atmospheric inlet valve. It is assumed that such a valve is not provided in the engine described. If so, I should like to suggest that if Mr. Messer makes up a small valve—similar to a clack, to let air into the cylinder of the engine with an adjustable weight on the valve-spindle—these stoppages will disappear. The load on this valve can be varied to give the best running. A small locomotive clack would do if it were lightly spring-loaded and some means of adjusting spring pressure were provided.

Yours faithfully,

Brighouse. R. D. BROADHEAD.

Club Announcements

Kodak Society of Experimenta Engineers and Craftsmen

On Thursday, November 11th last, representatives of the Harrow and Wembley, Watford, Edgware, G.E.C. and Kodak societies constituted a Brains Trust. The questions, too, were sent in by these various societies and, though they might well have covered a wider field, the session was interesting, informative and helpful.

During an interval, opportunity was taken of inspecting the replicas of early Fox Talbot cameras which have been recently made by the Kodak Society.

Our thanks are due to all those members and visitors who contributed towards the success of the evening. It is our hope that more meetings of this type—which go a long way towards bringing neighbouring societies more closely together—will be held in the future.

Hon. Publicity Secretary: C. R. L. COLES.

Stockport and District Society of Model Engineers

On December 17th Mr. Gerrard will give a talk and demonstration on "Some Uses of the Stroboscope," at 8 p.m., at the Dyers' and Bleachers' Club, Tiviot Dale. We shall be pleased to welcome visitors, particularly members of other societies.

Hon. Secretary: G. LINDSEY, 292, Bramhall Lane South, Bramhall, Stockport. Phone: Bramhall 58.

The Kent Model Engineering Society

At the recent A.G.M., the following officers were elected:—Chairman, Mr. V. Wattingham; Secretary, Mr. F. H. Gray; Treasurer, Mr. J. Ash.

The society has commenced the construction of a semi-permanent track in multi-gauge, and half of the required 100 concrete supports are already made. The track will be in the shape of an L to begin with, and ultimately it is hoped to have a continuous run of 600 ft.

Meetings are arranged up to the end of the year:—

Dec. 13th. "Precision Measuring," by Messrs. Ash and Tidey.

Dec. 20th. "The Production of a Newspaper," by Mr. Woolf.

Hon. Secretary: F. H. GRAY, 73, Sangley Road, Catford, S.E.6.

The Junior Institution of Engineers

North-Western Section. Friday, December 10th, Royal Society of Arts, John Adam Street, Adelphi, W.C.2. Inaugural meeting of 68th session. R. A. Riddles Esq., C.B.E., M.I.Mech.E., M.I.Loco.E., will present the awards won by members during the past session. Mr. R. A. Riddles will induct Sir Noel Ashbridge, F.K.C., B.Sc.(Eng.), M.I.C.E., M.I.E.E., F.I.R.E., as president of the Institution, who will then deliver his Presidential Address entitled "New Developments in Broadcasting."

Sheffield and District Section. Monday, December 13th, at 7 p.m., Sheffield Metallurgical Club, West Street, Sheffield. Ordinary meeting. Paper, "Machinery for Motor-driven, High-speed War Vessels," by E. Scott. (Member.)

Friday, December 17th, at 6.30 p.m., 39, Victoria Street, S.W.1. Ordinary meeting. "Fuel Efficiency as applied to Heating and Domestic Boilers," by B. H. Shoard, M.Inst.F. (Member), and "The Efficient Operations of Industrial Boiler Plants," by John Gayfer, M.Inst.F. (Member.)

Thursday, December 30th, at 6.30 p.m., 39, Victoria Street, S.W.1. Film evening. Barber Greene equipment.

Friday, January 7th, at 6.30 p.m., 39, Victoria Street, S.W.1. Film evening. "Wheels Behind the Wheels," to be introduced by H. Bromage.

North-Western Section. Monday, January 10th, at 7 p.m., The Manchester Geographical Society, 16, St. Mary's Parsonage, Manchester. Chairman's Address, "Ships of the Fishing Fleet," by R. Bayes. (Chairman and Member.)

Glasgow Society of Model Engineers

The next meeting will be held within the society's rooms at 60, Clarendon Street, Glasgow, N.W., on Saturday, December 11th, at 7.30 p.m.

At this meeting E. A. Keay will speak upon his 5-in. gauge 2-8-2 locomotive; which fact ought to ensure a full house.

The Edinburgh S.M.E. have arranged a *joint day* within their clubrooms, at Ramsay Lane, on Saturday, December 18th, at 3.30 p.m. The programme will take the form of a "Parts in Progress" session, to be followed by tea. It is important that the Edinburgh people know how many to cater for, and intending participants should give early notice to either secretaries, or add their names to a list to be provided.

Visitors will be welcomed and particulars of membership can be had from the Secretary, JOHN W. SMITH, 785, Dumbarton Road, Glasgow, W.1.

The Society of Model and Experimental Engineers

Members are reminded that the annual general meeting will be held at Caxton Hall, Westminster, S.W.1, at 2.30 p.m., on December 18th, when important amendments to the rules will be considered.

From the date of the A.G.M., Mr. A. B. Storrar, 67, Station Road, West Wickham, Kent, will take over the duties of hon. secretary.

Hon. Secretary: E. L. ASHTON, 20, Pollards Hill West Norbury, S.W.16.

Edinburgh Society of Model Engineers

The inaugural meeting of the ensuing session was opened by a film show given through the courtesy of Messrs. Hepworth & Grandage, and Messrs. Guest, Keen & Nettlefold before a large and appreciative audience in the society's club rooms.

The next meeting takes the form of a visit from the Glasgow Society of Model Engineers on Saturday, December 18th, at 3.30 p.m., and we hope that there will be a large turn out of members with their "bits and pieces."

The workshop and clubrooms are open on Tuesday evenings and Saturday afternoons, and all interested are welcome.

Hon. Secretary: JAMES H. FARR, Wardie Garage, Ferry Road West, Edinburgh, 4.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER "The Model Engineer," 23, Great Queen Street, London, W.C.2.